

## SECTION 13125

### PRE-ENGINEERED METAL BUILDINGS

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This is a performance specification for a metal building and foundations designed by a Contractor.  
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#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Design requirements for metal building, foundation, materials, products, fabrication and installation of pre-engineered metal building.

##### 1.2 RELATED SECTIONS

- A. Concrete work is specified in Division 3.
- B. Doors and finish hardware are specified in Division 8.

##### 1.3 SYSTEM DESIGN CRITERIA AND PERFORMANCE REQUIREMENTS

- A. General: Engineer, design, fabricate and erect the pre-engineered metal building system to withstand loads from winds, seismic forces, gravity, structural movement including movement thermally induced, and to resist in-service use conditions that the building will experience including exposure to weather, without failure or visible deformation.

- 1. Design each member to withstand stresses resulting from combinations of loads that produce the maximum stresses in that member.
- 2. Use design loads or combinations of loads as prescribed in MBMA's "Design Practices Manual" or as set forth herein, whichever is more demanding.

- B. Design Loads and Criteria

- 1. Minimum Design Loads:

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- a. The spec writer shall specify design loads, load combinations, wind, seismic criteria, etc., based on Section 206, Design Loads, in the Civil Technical Standards.
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- b. Include collateral loads from suspended mechanical and electrical systems, from ceilings and all other construction suspended from or supported by the metal building.

- c. In load combination of dead load plus live load, use a minimum total dead load (including 10 psf future load) of 20 psf. In load combinations that include the effects of wind uplift or overturning, use a minimum total dead load of 7 psf.

- 2. Floor Loads

- a. Design for a floor load of [ ] psf, or for specific equipment loads, whichever is greater.

C. Foundations

1. Design foundation to match floor plan and details shown on architectural drawings. Coordinate details of foundation to match structural details of prefabricated building systems.
2. Design maximum bearing loads on footings to be less than those recommended by geotechnical engineering report. Geotechnical engineering report will be provided to contractor by Los Alamos National Laboratory. Design floor slabs for maximum stated floor loading or fork lift wheel load, whichever produces the greatest slab thickness requirements.
3. Prepare all foundation design calculations under the supervision of a registered structural engineer.

D. Structural Framing, Roof and Siding Panels: Design primary and secondary structural members and exterior covering materials for applicable loads and combinations of loads.

1. Structural Steel: AISC, "Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design".
2. Cold-Formed Steel: AISI, "Specifications for the Design of Cold Formed Steel Structural Members" and "Design of Light Gauge Steel Diaphragms" for design requirements and allowable stresses.
3. Welded Connections: AWS, "Structural Welding Code" for welding procedures.

1.4 SUBMITTALS

A. Submit the following in accordance with the requirements of Section 01300.

1. Detailed design calculations for foundation and structural building components prepared and sealed by a registered structural engineer. Calculations shall meet the design criteria given.
2. Manufacturer's catalog data, including performance and loading charts, specifications and installation instructions for building components and accessories.
3. Color samples of the following items: Contract Administrator's review will be for color and texture only. Compliance with other requirements is the responsibility of the Contractor.
  - a. For initial selection, submit manufacturer's color charts or chips showing full range of colors, textures and patterns available for metal panels with factory applied finishes.
  - b. For verification purposes, submit 12 inch long by actual width of roofing and siding panels in the profile, style, color and texture selected from the manufacturer's colors.
  - c. For initial selection, submit manufacturer's color charts or chips showing full range of colors available for sealants and closures.
4. Shop Drawings:
  - a. Shop drawings sealed by a registered structural engineer.
  - b. Shop drawings of the foundations and slabs indicating reinforcing and

anchor bolt locations.

c. Shop drawings of the metal building indicating:

- Fabrication and assembly of the structural frame in accordance with the AISC Manual of Steel Detailing,
- Layout of siding and roofing panels, details of all edge conditions, joints, corners, custom profiles, supports, anchorages, trims, flashings, covering and trim, and accessory installations,
- Window anchorage and flashing.
- Door frame anchorage.

5. Warranty:

a. Twenty year manufacturer's written warranty on the exterior panel and trim finish. The finish shall be warranted against the following:

- Crack, check, or peel.
- Chalk in excess of a numeral rating of eight (ASTM S659).
- Fade or change in color in excess of five units of color (ASTM D2244).

b. Ten year warranty for weathertight and watertight installation.

6. Project record documents in accordance with Section 01720.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Provide pre-engineered metal buildings produced by a manufacturer with a minimum of 5 years experience in the fabrication of pre-engineered metal buildings of the type and quality required.
- B. Erector's Qualifications: Pre-engineered building shall be erected by a firm that has successful experience in the erection of pre-engineered buildings similar to those required for this project, having completed a minimum of 5 projects, and that has been licensed by the manufacturer of the building system.

## 1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver prefabricated components, sheets, panels, and other manufactured items so they will not be damaged or deformed. Package metal sheets or panels for protection against transportation damage.
- B. Exercise care in unloading, storing and erecting panels to prevent bending, warping, twisting and surface damage.
- C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store metal sheets or panels so that water accumulations will drain freely. Do not store sheets or panels in contact with other materials which might cause staining, denting or other surface damage.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### A. Metals:

1. Hot-Rolled Structural Shapes: ASTM A36 or A529.
2. Tubing: ASTM A500, Grade B.
3. Pipe: ASTM A53, Grade B.
4. Steel Members Fabricated from Plate or Bar Stock: ASTM A529, A570, or A572, 42,000 psi minimum yield strength.
5. Steel Members Fabricated by Cold Forming: ASTM A607, Grade 50.
6. Cold-Rolled Carbon Steel Sheet: ASTM A568 and ASTM A336.
7. Hot-Rolled Carbon Steel Sheet: ASTM A568 or ASTM A569.
8. Structural Quality Zinc-Coated (Galvanized) Steel Sheet: ASTM A446 with G90 coating, ASTM A525. "Class" to suit building manufacturer's standards.
9. Commercial Quality Zinc-Coated (Galvanized) Steel Sheet: ASTM A526 with G60 coating, ASTM A525.
10. Aluminum-Coated Steel Sheets: ASTM A463 with TI-40 coating.
11. Bolts for Structural Framing: ASTM A325 as necessary for design loads and connection details.

#### B. Paint and Coating Materials: Unless otherwise indicated, paint and coating materials shall comply with performance requirements of the Federal Specifications indicated. Unless specifically indicated otherwise, compliance with compositional requirements of the federal specifications indicated is not required.

1. Shop Primer for Ferrous Metal: Fast curing, lead-free, "universal" primer as selected by the manufacturer for resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure. Comply with performance requirements of FS TT-P-645.
2. Shop Primer for Galvanized Metal Surfaces: Zinc dust-zinc oxide primer selected by the manufacturer for compatibility with substrate. Comply with performance requirements of FS TT-P641.

### 2.2 STRUCTURAL FRAMING

- #### A. Fabricate steel frames from hot-rolled structural steel. Provide built-up "I-beam" shape or open web type frames consisting of either tapered or parallel flange beams and tapered or straight columns. Provide frames factory welded and shop painted. Furnish frames complete with attachment plates, bearing plates, and splice members. Factory drill frames for bolted field assembly.
1. Provide length of span and spacing of frames as indicated. Slight variations in length of span and frame spacing may be acceptable if necessary to meet manufacturer's standard.

2. Provide endwall frames where noted on the floor plans. Use moment-resisting frames where noted on the floor plans.
- B. Wind Bracing: Adjustable wind bracing using not less than 1/2 inch diameter threaded steel rods; ASTM A36 or A572, Grade D.
- C. Secondary Framing:
1. Roof Purlins, Sidewall and Endwall Girts: "C" or "Z" shaped sections fabricated from not less than 16 gage (0.0598 inch) shop painted rolled formed steel. Fabricate purlin spacers from not less than 14 gage (0.0747 inch) cold formed "J" sections.
  2. Eave Struts: Unequal flange "C"-shaped sections formed to provide adequate backup for both siding and roof panels. Fabricate from not less than 16 gage (0.0598 inch) shop painted cold formed steel.
  3. Flange and Sag Bracing: Minimum 1 5/8 inch angles fabricated from not less than 16 gage (0.0598-inch) shop painted cold formed steel.
  4. Base or Sill Angles: Angles fabricated from not less than 14 gage (0.0747 inch) cold formed galvanized steel sections.
- D. Bolts:
- Provide high strength bolts, meeting ASTM A325 specifications except when structural framing components are in direct contact with roofing and siding panels. Provide zinc-plated or cadmium-plated bolts when structural framing components are in direct contact with roofing and siding panels.
- E. Shop Painting: Clean surfaces to be primed of loose mill scale, rust, dirt, oil, grease and other matter precluding paint bond. Follow procedures of SSPC-SP3 for power tool cleaning, SSPC-SP7 for brush-off blast cleaning, and SSPC-SP1 for solvent cleaning.
1. Prime structural steel primary and secondary framing members with the manufacturer's standard rust-inhibitive primer.
  2. Prime galvanized members, after phosphoric acid pretreatment with manufacturer's standard zinc dust-zinc oxide primer.

## 2.3 METAL PANELS

- A. General: Provide roofing, siding, liner and soffit sheets formed to the general profile or configuration customarily utilized by the metal building system manufacturer to meet the project requirements with metal thickness not less than 24 gage (0.0179 inch).
1. Zinc-Coated Steel Sheets for Liner and Siding: Structural quality hot-dip galvanized steel sheets, ASTM A446, Grade C, with G90 coating, ASTM A525.  
  
Include appropriate surface treatment for maximum finish performance.
  2. Aluminized Coated Steel Sheets for Roofing: Drawing quality aluminum coated steel sheets, ASTM A463, with T1-40 coating.
- B. Standing Seam Roof Panels: Manufacturer's standard factory-formed standing seam roof panel system designed for mechanical attachment of panels to roof purlins using a concealed clip. Form panels of 24 gage aluminized coated steel sheets, ASTM A463, with T1-40 coating.

1. Clips: Not less than 16 gage panel clips.
  2. Cleats: Factory caulked, mechanically seamed cleats formed from 24 gage galvanized steel, ASTM A463, with T1-40 coating.
- C. Siding Panels: Manufacturer's standard factory-formed panel system designed for mechanical attachment of panels to girts using exposed fasteners. Form panels of minimum 24 gage zinc-coated steel sheets, ASTM A446, Grade C, with G90 coating, ASTM A525. Include appropriate surface treatment for maximum finish performance.
- D. Liner Panels: Manufacturer's standard factory-formed panel system designed for mechanical attachment of panels to girts using exposed fasteners. Form panels of minimum 24 gage zinc-coated steel sheets, ASTM A446, Grade C, with G90 coating, ASTM A525. Include appropriate surface treatment for maximum finish performance.

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If lab benches, etc will be located backing up to liner panels, consider specifying liner panels to have flush finished surface. It's more expensive, but it may be the best solution.  
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- E. Soffit Panels: Manufacturer's factory-formed, soffit panel system designed for mechanical attachment of panels using exposed fasteners. Form panels of minimum 26 gage zinc-coated steel sheet, ASTM A446, Grade C, with G90 coating, ASTM A525. Include appropriate surface treatment for maximum finish performance.
- F. Fasteners: Manufacturer's standard self-tapping screws, bolts, nuts, self-locking rivets, self-locking bolts, end-welded studs, and other suitable fasteners as required to withstand design loads.
1. Provide metal-backed neoprene washers under heads of fasteners bearing on weather side of panels.
  2. Use aluminum or stainless steel fasteners for exterior application and galvanized or cadmium plated fasteners for interior applications.
  3. Locate and space fastenings in true vertical and horizontal alignment. Use proper type fastening tools to obtain controlled uniform compression for positive seal without rupture of neoprene washer.
  4. Provide fasteners with heads matching color of siding sheets by means of plastic caps or factory applied coating.
- G. Accessories: Provide the following sheet metal accessories factory formed of the same material and finish as the corresponding roofing, siding and liner panels. Accessories include, but are not necessarily limited to:
1. Flashings.
  2. Closers.
  3. Fillers.
  4. Metal expansion joints.
  5. Ridge covers.
  6. Fascias.
  7. Gutters and downspouts.

- H. Flexible Closure Strips: Closed-cell, expanded cellular rubber, self-extinguishing flexible closure strips. Cut or pre-mold closure strips to match corrugation configuration of roofing and siding sheets. Provide closure strips where indicated or necessary to ensure weathertight construction.
- I. Sealing Tape: Pressure sensitive 100 percent solids grey polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, non-sag, non toxic, non staining tape not less than 1/2 inch wide and 1/8 inch thick.
- J. Joint Sealant: One-part elastomeric polyurethane, polysulfide or silicon rubber sealant as recommended by the building manufacturer.
- K. Panel Finish: Provide one of the following as indicated:
  - 1. Baked Enamel Finish: Shop-applied baked enamel finish to galvanized steel liner panels, and related trim and accessory elements. Apply finish coat on the exposed face and manufacturers' standard wash coat on the reverse face.
    - a. Clean galvanized steel with an alkaline compound, then treat with a zinc phosphate conversion coating, and seal with a chromic acid rinse.
    - b. Apply a baked-on thermo-setting synthetic enamel system, such as acrylic enamel or silicone polyester, to pretreated steel sheets, in one or more coats as standard with the manufacturer to achieve a minimum dry film thickness of one mil.
    - c. For roofing and siding, apply finish coat on exterior facings and manufacturers's standard wash coat on reverse face.
    - d. Provide colors as indicated or as selected by Contract Administrator from the manufacturer's standard colors.
  - 2. Fluoropolymer Finish: Shop-applied fluoropolymer finish to galvanized steel siding and soffit panels, and related trim and accessories elements. Apply finish coat on the exposed face and manufacturer's standard wash coat on the reverse face.
    - a. Clean galvanized steel with an alkaline compound, then treat with a zinc phosphate conversion coating, and seal with a chromic acid rinse.
    - b. Apply a 2 coat fluoropolymer coating system to pretreated steel. Coating shall consist of a primer applied to a dry film thickness of 0.15 mil to 0.25 mil, and a finish coat of polyvinyl fluoride or polyvinylidene fluoride applied to a dry film thickness of 0.80 mils to 1.3 mils.
    - c. Color as indicated or as selected by Contract Administrator from the manufacturer's standard colors.

## 2.4 ALUMINUM WINDOWS

- A. Window Classification:
  - 1. Commercial Windows: Provide preglazed window units complying with requirements of NAAMA Grade and Performance Class appropriate to the design wind velocity at project site listed elsewhere in this Section and for "Commercial" type buildings.

2. Window Types (Operation): Drawings indicate locations of operating sash:
  - a. Provide horizontal sliding units conforming to NAAMA HS-C20 for commercial grade horizontal sliding windows.
- B. Aluminum Extrusions: ASTM B221 aluminum extrusions of alloy and temper recommended by the manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000 psi ultimate tensile strength and not less than 0.062 inch thickness at any location for main frame and sash members.
  1. Aluminum finish: Medium natural anodized, NAAMM AA-C22A31.
  2. Provide thermal-break construction of window units. Metal frame and sash members exposed on the exterior shall be separated from metal parts exposed on the interior by a continuous gasket or filler of rubber or plastic, locked into construction.
  3. Mullions: Provide mullions between adjacent window units, fabricated of extruded aluminum matching the finish of window units.
- C. Glass Types and Qualities:
  1. Dual glazed insulating glass made with Type 1, Class 1, Quality q3, clear float glass.
- D. Insect Screens: Provide removable insect screen unit on each operable exterior sash, with color matching window sash extrusions.
  1. Plastic Fabric Insect Screen: Plastic coated glass fiber mesh, FS L-S-125, 18 by 14, woven and fused.

## 2.5 SHEET METAL ACCESSORIES

- A. General: Provide sheet metal accessories with coating to match coated steel roofing, liner and siding panels.
- B. Gutters: Form gutters in sections not less than 8 feet in length, complete with end pieces, outlet tubes and other special pieces as may be required. Join sections with riveted and soldered or sealed joints. Provide expansion-type slip joint at center of runs. Furnish gutter supports spaced at 36 inches o.c., constructed of same metal as gutters. Provide bronze, copper, or aluminum wire ball strainers at each outlet. Finish to match roof fascia and rake.
- C. Downspouts: Form downspouts in sections approximately 10 feet long, complete with elbows and offsets. Join sections with not less than 1 1/2 inch telescoping joints. Provide fasteners, designed to securely hold downspouts not less than 1 inch away from walls; locate fasteners at top and bottom and at approximately 5 feet on center in between. Finish to match wall panels.
- D. Wall Louvers: Provide wall louvers of the size and design indicated, fabricated of not less than 18 gage steel. Fold or bead blades at edges, set at an angle that will exclude driving rains, and secure to frames by riveting or welding. Finish to match wall panels.
  1. Provide vertical mullions for louvers 4 feet and more in width, with not less than one mullion for each 4 feet of width.
  2. Provide flanges on interior face of frames where air intake or exhaust louvers are indicated to be connected with mechanically-operated dampers or metal ductwork.



3. Provide bird screens of 1/2 inch by 1/2 inch galvanized steel mesh in rewirable frames on exterior face of louvers. Secure screens with clips to ensure ease of removal for cleaning and rewiring. Fabricate screens and frames of same type metal as louvers.

## 2.6 FABRICATION

- A. General: Design prefabricated components and necessary field connections required for erection to permit easy assembly and disassembly. Fabricate components in such a manner that once assembled, they may be disassembled, repackaged and reassembled with a minimum amount of labor.
  1. Clearly and legibly mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams and instruction manuals.
- B. Structural Framing: Shop fabricate structural framing components to the indicated size and section complete with base plates, bearing plates and other plates required for erection, welded in place. Provide required holes for anchoring or connections either shop drilled or punched to template dimensions.
  1. Shop Connections: Power riveted, high strength bolted or welded shop connections.
  2. Field Connections: Bolted field connections using high strength bolts (ASTM A minimum specification).

## PART 3 EXECUTION

### 3.0 FOUNDATION CONSTRUCTION

- A. Construct foundations/floor slab to lines and grades shown on architectural and civil drawings to meet pre-fabricated metal building requirements. Construct foundations in accord with specification sections or excavation, backfill, concrete, reinforcing and formwork.
- B. Coordinate construction of the foundation with the anticipated installation requirements of the prefabricated building system. Set all anchor bolts in the formwork prior to placement of concrete by the use of templates. Field drilled structural anchors or excessive field burning of base plates is prohibited.
- C. Place and finish floor slabs in accord with the specification section or concrete. Coordinate all embedded item with foundation construction prior to placement of concrete.
- D. Remove concrete that is defective, below minimum strength requirements as exhibited by the test cylinders, as required by the Construction Inspector. Replace defective concrete at no cost to the University.

### 3.1 ERECTION OF STRUCTURAL FRAMING

- A. Framing: Erect structural framing true to line, level and plumb, rigid and secure. Level base plates to a true even plane with full bearing to support structures, set with double-nutted anchor bolts. Use a non-shrinking grout to obtain uniform bearing and to maintain a level base line elevation. Moist cure grout for not less than 7 days after placement.
- B. Purlins and Girts: Provide rake or gable purlins with tight fitting closure channels and fascias. Locate and space wall girts to suit door and window arrangements and heights. Secure purlins and girts to structural framing and hold rigidly to a straight line with sag rods.

- C. Bracing: Provide diagonal rod or angle bracing in both roof and sidewalls as required by building analysis.
  - 1. Where diaphragm strength of roof or wall covering is adequate to resist wind forces and connections are detailed to provide diaphragm strength, rod or other forms of bracing will not be required.
- D. Framed Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical or electrical work. Securely attach to building structural frame.

### 3.2 ROOFING AND SIDING

- A. General: Arrange and nest sidelap joints so that prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or J application not true to line. Protect factory finishes from damage.
  - 1. Field cutting of panels by torch is not permitted.
  - 2. Provide weatherseal under ridge cap. Flash and seal roof panels at eave and rake with rubber, neoprene, or other closures to exclude weather.
- B. Standing Seam Roof Panel System: Fasten roof panels to purlins with concealed clip in accordance with the manufacturer's instructions.
  - 1. Install clips at each support using self-drilling fasteners.
  - 2. At end laps of panels install tape caulk between panels.
  - 3. Install factory-caulked cleats at standing seam joints. Machine seam cleats to the panels to provide a weather-tight joint.
- C. Siding and Liner Panels: Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as necessary for waterproofing. Handle and apply sealant and back-up in accordance with the sealant manufacturer's recommendations.
  - 1. Align bottoms of wall panels and fasten panels with blind rivets, bolts or self-tapping screws. Fasten flashings, trim around openings, and similar elements with self-tapping screws. Fasten window and door frames with machine screws or bolts. When building height requires 2 rows of panels at gable ends, align lap of gable panels over wall panels at eave height.
  - 2. Install screw fasteners with power tool having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
- D. Sheet Metal Accessories: Install gutters, downspouts, ventilators, louvers, and other sheet metal accessories in accordance with manufacturer's recommendations for positive anchorage to building and weathertight mounting. Adjust operating mechanism for precise operation.
- E. Aluminum Windows: Anchor windows securely in place. Seal entire perimeter of each unit with elastomeric sealant used for panels. Adjust and lubricate operating sash (vents) and hardware for proper operation. Clean surfaces of window units and install screens.
- F. Cleaning and Touch-Up: Prior to application of finish coats, clean component surfaces of matter which could preclude paint bond.

1. Touch-up abrasions, marks, skips or other defects to shop-primed surfaces with same type materials as shop primer.

END OF SECTION